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PART III

DEPARTMENT OF THE INTERIOR

Geological Survey

■

WARNING AND PREPAREDNESS FOR GEOLOGIC-RELATED HAZARDS

Proposed Procedures

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GEOLOGICAL SURVEY AUTHORITY FOR ISSUING WARNINGS OF GEOLOGIC-RELATED HAZARDS

Under the broad responsibilities assigned to the Geological Survey by its Organic Act of 1879 for the "examination of the geological structure" of the United States, the Survey has for many decades undertaken studies of earthquakes, volcanoes, and other natural hazards. In recent years, as knowledge of these and related geologic phenomena has increased, the Survey has also developed capabilities for predicting some potentially hazardous events in some areas, and has the implicit obligation to inform civil authorities and the public of such predictions.

On May 22, 1974, Congress enacted Public Law 93-288 (88 Stat. 143), which is known as the "Disaster Relief Act of 1974" (hereinafter, "the Act") "to provide an orderly and continuing means of assistance by the Federal Government to State and local governments in carrying out their responsibilities to alleviate the suffering and damage which result from * * * disasters * * *" Section 202(a) of the Act states that "The President shall insure that all appropriate Federal agencies are prepared to issue warnings of disasters to State and local officials." In addition, Section 202(b) states that "The President shall direct appropriate Federal agencies to provide technical assistance to State and local governments to insure that timely and effective disaster warning is provided." The disasters included are "hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other catastrophe * * *" The Act further states in Section 308 that "The Federal Government shall not be liable for any claim based upon the exercise or performance of or the failure to exercise or perform a discretionary function or duty on the part of a Federal agency or an employee of the Federal Government in carrying out the provisions of this Act."

Executive Order 11795 entitled, "Delegating Disaster Relief Functions Pursuant to the Disaster Relief Act of 1974" (30 FR 25939, July 11, 1974) delegates to the Department of Housing and Urban Development the authority to exercise certain of the powers and authorities of the President with respect to Federal disaster assistance. Pursuant to the authority conferred by Section 1 of E.O. 11795, the U.S. Department of Housing and Urban Development conferred limited responsibility under the Act to the Secretary of the Interior (40 FR 52927, November 13, 1975). This authority was, in turn, redelegated by the Secretary of the Interior (Departmental Manual, 220 DM 8, Release 1883, May 3, 1976), "subject to the general policy guidance and coordination of the Assistant Secretary—Energy and Minerals," to the Director, Geological Survey, who is "empowered to exercise the authority, functions, and powers granted by Section 202 of the Disaster Relief Act of 1974 with respect to disaster warnings for an earthquake, volcanic eruption, landslide, mudslide, or other geological castastrophe."

PURPOSE OF STATEMENT

The purpose of this statement is to describe the Geological Survey's capabilities and limitations for advance recognition and warning of various kinds of geologic-related hazards and the procedures proposed to carry out the responsibilities delegated under the Act, and to elicit public comment on the proposed procedures. Application of these capabilities and procedures is largely limited to areas where Geological Survey research and field studies are ongoing. This statement should not be interpreted as indicating the existence of a nationwide operational capability to issue notifications, watches, and warnings of hazardous conditions wherever and whenever they may exist.

Comments regarding these procedures and policies are invited. Comments received by June 30, 1977 will be taken into account in subsequent revisions as appropriate. Comments should be addressed to:

Director, U.S. Geological Survey, National Center, 12201 Sunrise Valley Drive, Reston, Virginia 22092.

V. E. MCKELVEY,
Director,
U.S. Geological Survey.

1. DEFINITIONS

For the purpose of this statement, a geologic hazard is a geological condition, process, or potential event that poses a threat to the health, safety, or welfare of a group of citizens or to the functions or economy of a community or larger governmental entity. A geological disaster or catastrophe is the occurrence of a severe hazardous event. In the context of this statement, the terms "Notice of Potential Hazard," "Hazard Watch," and "Hazard Warning" refer to the issuance of technical information to officials responsible for public safety and to the news media; recommendations or orders to take defensive actions are issued by officials of State and local governments, where the police and public safety authority rests in our governmental system. These terms are defined as follows:

Notice of potential hazard.—The communication of information on the location and possible magnitude or geologic effects of a potentially hazardous geologic event, process, or condition.

Hazard watch.—The communication of information, as it develops from a monitoring program or from observed precursor phenomena, that a potentially catastrophic event of generally predictable magnitude may be imminent in a general area or region and within an indefinite time period (possibly months or years).

Hazard warning.—The communication of information (prediction) as to the time (possibly within days or hours), location, and magnitude of a potentially disastrous geologic event or process.

2. CAPABILITIES TO PREDICT HAZARDOUS EVENTS

(a) Geologic processes and conditions that could result in harm to people and property include earthquakes, volcanic eruptions, landslides, mudflows, subsidence, faulting and fissuring of the ground surface, and glacier-related phenomena such as release of glacier-dammed lakes and rapid ice surges or retreats. Under certain conditions, these events may occur suddenly and affect large numbers of people and property over a wide area; in other instances, however, the processes involved occur slowly or affect very limited areas so that few if any people are endangered.

(b) The present capability of scientists to predict hazardous events varies greatly as to the type of event and as to knowledge of its time, place, and magnitude of effects.

(1) Earthquakes.

(a) *Geographic distribution.* Much of the United States is subject to some degree of earthquake hazard. The western states of Alaska, California, Hawaii, Idaho, Montana, Nevada, New Mexico, Utah, Washington, and Wyoming are particularly susceptible, but major earthquakes have also struck the eastern and central parts of the United States (Hadley and Devine, 1974), particularly Arkansas, Georgia, Kentucky, Indiana, Illinois, Massachusetts, Mississippi, Missouri, New York, North Carolina, South Carolina, and Tennessee.

(b) *Effects.* (i) Earthquake-generated ground shaking, in many instances, causes the most widespread earthquake damage, principally through failure of buildings. Earthquakes also give rise to various geologic processes that may cause injuries and property damage, including surface faulting, landsliding and associated ground failures, generation of large waves in water bodies, and regional vertical movements (downwarping and upwarping).

(ii) The surface effects of earthquakes have been evaluated on the basis of geologic and seismologic studies in parts of Alaska (Page, et al., 1972),[1] California (Borcherdt, 1975), Idaho (Witkind, 1972), Nevada (Bingler, 1974), Utah (U.S. Geol. Survey, 1976), Washington (Pitt, 1972; and U.S. Geol. Survey, 1975), and the eastern United States (Dutton, 1889). The results of regional studies underway in these and other states will be published as they are completed.

(c) *Prediction capability.* (i) Predictions of the precise location, time, and magnitude of specific earthquakes cannot generally be made now. Certain precursors, such as ground tilting and changes in water levels in wells, the magnetic field, and seismic wave velocity

[1] References here and elsewhere in this statement are representative rather than exhaustive of descriptions of the phenomena involved.

characteristics in rock, may be useful in predicting earthquakes. Experimental instrumental arrays have been installed in a few research areas, such as near Hollister, California, to evaluate these precursors and to help develop an earthquake prediction capability.

(ii) Locations of faults that may be the source of future damaging earthquakes have been determined in some regions of the country, particularly in parts of Alaska, California, Nevada, Idaho, Montana, and Utah. Geologic and seimologic studies in these regions, however, are not adequate to assure that all such faults have been delineated. Geologic studies of recurrence intervals of earthquakes have been made on only a few faults, principally in California. Some of these studies provide a basis for estimating the magnitudes of earthquakes that are like to be generated by movement along a particular fault. Broad-scale estimates of the susceptibility of the various regions of the U.S. to earthquake hazards have been made and are published in earthquake hazard maps and reports (Algermissen and Perkins, 1976) which will be updated as new information is acquired. These maps, and the more detailed studies on which they are based, identify those regions known to be highly susceptible to earthquakes, even though they may not identify all faults along which movement may take place.

(iii) Regional earthquake hazard assessments are also underway in parts of New Mexico, New York, South Carolina, and Washington, and in the lower Mississippi Valley.

(2) Volcanic eruptions. (a) *Geographic distribution.* At the present time, volcanoes are active in Alaska and Hawaii; volcanoes in California, Oregon, and Washington are dormant, but have erupted within the last 150 years. The likelihood of future eruptions damaging to man is greatest in the vicinity of volcanoes in these States. Geologic evidence indicates that volcanic activity could occur in other areas, such as Arizona, Nevada, New Mexico, Wyoming, and Idaho (Mullineaux, 1976), where eruptions have occurred as recently as 350 years ago; there is no current evidence, however, to suggest that volcanic activity may occur in these areas in the near future. Broad estimates have been made of regional susceptibility and types of volcanic hazards in the conterminous U.S. and Hawaii and are being published (Crandell, 1976; Crandell and Mullineaux, 1975; Mullineaux, 1976; and Powers, 1948); these will be updated as new information is acquired.

(b) *Effects.* (i) Volcanic eruptions produce a wide variety of primary and secondary hazards to life and property, stemming mainly from hot avalanches, mudflows, ash falls, lava flows, volcanic gases, hot particle and gas clouds, and floods.

(ii) Studies of the products of past volcanic activity in the Cascade Range, including lava flows, ash falls, mudflows, and hot avalanches, have been completed on the volcanoes of Mt. Baker (Hyde and Crandell, 1975), Lassen Peak (Crandell, et al, 1974), Mt. Rainier (Crandell, 1973), and Mt. St. Helens (Crandell and Mullineaux, 1976; Crandell, et al, 1975); similar studies are planned or in progress for other major volcanoes in the Cascade Range, such as Mt. Hood and Mt. Shasta, and for Augustine Volcano in Alaska.

(iii) Detailed studies at Kilauea and Mauna Loa volcanoes in Hawaii show that the products of most historic and prehistoric eruptions are lava flows; subordinate products include ash falls and hot particle and gas clouds. Eruptions issue from fissures and vents, both in the summit areas and along rift zones on the flanks of the volcanoes. Assessments of hazard-susceptible areas have been made for the islands of Hawaii (Mullineaux and Peterson, 1974) and Oahu (Crandell, 1975).

(c) *Prediction capability.* (i) Kilauea and Mauna Loa volcanoes are monitored by an array of instruments and by systematic measurements which permit assessing the likelihood of impending activity (Waesche and Peck, 1966; Kinoshita, et al, 1974). Physical precursors often permit predictions to be made within time frames of weeks or days, and sometimes highly specific signals precede eruptions by one to several hours (Swanson, et al, 1971; Fiske and Kinoshita, 1969).

(ii) A study of the historic cycles of activity on Mauna Loa indicates the possibility of long term prediction of the general locality and the general time frame (months or years) of the next eruptive event (Lockwood, et al, 1976).

(iii) Predictive capability has not been achieved for volcanoes in the Cascade Range or Alaska, although it is possible that the methods developed in Hawaii might be modified and adapted to be useful in these regions. Detailed estimates of hazard-susceptible areas surrounding some of these and other volcanoes have been made as indicated in section (b) ii and iii. Other studies are underway and will be published as completed.

(3) Landslides (including mudflows and mudslides). (a) *Geographic distribution.* Landslides and related hazards occur in every state in the United States. They occur largely in areas of steep terrain, but also along river, valley, and beach bluffs in otherwise flat country. The general distribution of landslide incidence and susceptibility has been assessed for the conterminous U.S. and published as a national overview map at 1:7,500,000-scale (Radbruch-Hall, et al., 1976). This map will be updated as new information becomes available.

(b) *Effects* (i) Many landslides move slowly and commonly are not a great hazard to people. However, they are estimated to cause more than $1 billion damage to property annually.

(ii) Mud and debris flows generated by intense rainfall or rapid snowmelt, large landslides that move abruptly, rockfalls, and landslides into large reservoirs may be hazardous to people and property. Similarly, landslides that dam streams inundate property upstream and can produce severe and dangerous flooding downstream if the barrier is breached suddenly.

(c) *Prediction capability.* (i) A capability to predict the time, place, and magnitude of landslides is possible, but is limited to very small individual landslide areas in which detailed geologic and engineering studies have been conducted, including test borings and laboratory analysis. Consequently, general information on areas potentially susceptible to slope failures will be communicated as a Notice of Potential Hazard. Detection of precursors may allow prediction and warning of landslides in areas of special topical studies, as in the Santa Monica Mountains of southern California (Campbell, 1975).

(ii) In addition to the national overview map of landslide incidence and susceptibility, maps that show landslide deposits at a scale of 1:500,000 have been prepared for the State of Colorado (e.g., Colton, et al., 1976). Larger-scale (1:125,000, 1:62,500, and 1:24,000), more detailed assessments of landslide susceptibility have been made of a number of small areas and a few regions in various parts of the U.S. (Briggs, 1974; Nilsen, 1973; and Simpson, 1976). Such maps are published as they are completed.

(iii) Landslide hazards are evaluated incidental to regional mapping programs or as a part of general geologic hazards studies in selected areas. The Geological Survey is also attempting to delineate and reduce landslide hazards on a nationwide basis.

(4) Glacier-related phenomena. (a) *Geographic distribution.* Large glaciers that are most likely to be hazardous to people and property occur in Alaska and Washington. Smaller glaciers also occur in California, Colorado, Idaho, Montana, Oregon, and Wyoming. Although no regional or national overview of all glacier-related hazards has been made, the distribution of potentially hazardous surging glaciers has been analyzed (Post, 1969), and the areas susceptible to outburst flood hazards have been determined in Alaska (Post and Mayo, 1971) and the Pacific Northwest (Richardson, 1968).

(b) *Effects.* (i) The rate of advance and retreat of glaciers is generally so slow that there is little cause for concern except in the case of glacier surges and where glacier changes result in floods or icebergs. Rapidly advancing glaciers, and especially surging glaciers, may advance over transportation corridors or other works of man or may dam valleys, causing the formation of glacier-dammed lakes. Such lakes, which may also be formed by glacier retreat, may burst out periodically or sporadically, resulting in downstream flooding. Downstream flooding can also be caused by the periodic outbreak of water stored within or under glaciers.

(ii) Icebergs, which are formed by calving from the front of glaciers that end in the sea or large lakes, may be discharged at greatly increased rates when

a glacier starts to retreat or advance (Post, 1975). Retreating ice may also release ice-dammed lakes, resulting in potential flooding of downstream areas.

(iii) The effects of glacier-related hazards have been monitored in only a few isolated instances, such as flooding from glacial Lake George (Post and Mayo, 1971) and glacier outburst floods in Washington (Richardson, 1968).

(c) *Prediction capability.* (i) Long-term prediction of glacier advance and retreat is not possible; however, short-term predictions may be possible with adequate field measurements on the glacier itself. The outbursts of some glacier-dammed lakes can be predicted through the monitoring of lake levels if an adequate history of previous outbursts is available, or if the rate of inflows and the configuration of the glacier bed are known. The prediction of outbursts of water, from within a glacier may be possible, in some cases, given a history of past events and the continuous monitoring of the ice flow pattern of the glacier. Prediction of the size and rate of ice calving from glaciers fronting in the sea or lakes may be possible using photography.

(ii) Areas of susceptibility to glacier-related hazards, as indicated under (a), have been observed, using aircraft and satellite imagery, but available resources do not permit a systematic monitoring program.

(5) Subsidence. (a) *Causes and geographic distribution.* Subsidence is the slow lowering or sudden collapse of the land surface and is common in many areas of the United States. Subsidence, both man-induced and natural, may result from:

Slow compaction of sediments from withdrawal of (1) ground water, as in parts of Arizona, California, and Texas, (2) hydrocarbons, as in parts of California and Texas, and (3) potentially, fluids for geothermal production in California and the Gulf Coast;

Slow to rapid collapse of the roof above mines because of inadequate support as in many coal mine areas of Colorado, North Dakota, Pennsylvania, and Washington, or where solution mining creates excessively large underground openings as in Kansas, Michigan, and Texas;

Slow to rapid compaction of certain types of materials in which the soil structure collapses when water is added, as in the San Joaquin Valley, California, or when water is expelled as the result of liquefaction during earthquakes,

Slow to rapid collapse over caves, caverns, and solution openings in limestone (karst) areas, as in many southern states and elsewhere; and

Rapid earthquake movement or earth flexuring, principally in Alaska, California, and Hawaii.

The results of topical research projects are released in maps and reports as they are completed.

(b) *Effects.* i. Subsidence normally is a slow process and is not hazardous to life. However, under certain circumstances, where the ground above mines and caverns collapses suddenly, where subsided ground in coastal areas may be inundated by storm waves, and where localized subsidence is severe and affects critical structures such as dams, damage to property, and indirectly to life, may be extensive (Castle and Yerkes, 1976).

ii. Earth fissures (large open cracks) can develop from fluid withdrawal or collapse over cavities. These fissures can damage structures and render property virtually useless for most purposes.

(c) *Prediction capability.* i. Specific subsidence events caused by groundwater withdrawal can be anticipated in certain areas, such as in parts of Alabama (Newton, 1976), California (Lofgren, 1975; and Poland, 1971), and Texas (Gabrysch, 1969), where studies are underway. Once subsidence involving slow compaction of sediments is initiated, the rate can be measured, and in some cases, the ultimate amount can be estimated.

ii. There is no nationwide subsidence program; however, efforts are underway to identify or delineate areas of existing or potential subsidence at small scale (Poland and Davis, 1969; and Davies, et al., 1976). Such hazards also are mapped incidental to general research projects completed or underway in several areas of the country.

3. PROVISIONAL PROCEDURES TO REPORT HAZARDOUS CONDITIONS

When and where information is obtained that suggests the development of a hazardous condition, the U.S. Geological Survey will attempt to authenticate it, and communicate such information to appropriate State, local and Federal authorities and to the public. The U.S. Geological Survey recognizes that providing earth-science information, in accordance with its expertise, is only the first of the inputs needed by State and local governments and the public in mitigating the effects of geologic hazards. The actual adoption of the most effective mitigation measures by local authorities will result from a cooperative effort by agencies at all governmental levels and by non-governmental organizations and the public. Decisions for adoption of such mitigation measures should be based upon a broad range of earth-science, engineering, and socio-economic information.

a. *Hazard Identification.*—Information acquired by Geological Survey personnel that indicates a region, area, or locality may be susceptible to geologic or hydrologic conditions or processes that could pose a significant potential hazard to life or property will be conveyed promptly to the Director of the Gological Survey with all supporting evidence and documentation.

b. *Hazard Evaluation.* (1) The Director will submit information pertaining to potentially hazardous conditions or events to carefully selected scientific evaluation panels for review of the scientific basis for the hazard identification. Such panels may be established formally, such as the Survey's Earthquake Prediction Council, which relies on scientific expertise pertaining to a specific type of hazard; or informally, with scientist members changing according to their expertise with different types or areas of potential hazards. Upon review of the evidence, the evaluation panel(s) will transmit the findings and recommendations to the Director. The panel may find that:

(a) A hazard to life or property is unlikely or insufficiently defined to justify a Notice of Potential Hazard without additional information;

(b) A potential hazard to life and/or property exists;

(c) The potential hazard exists and that monitoring by the Geological Survey could lead to a better definition of location or magnitude, extent, or timing of the hazard; or

(d) The hazard conditions are sufficiently well defined as to location, magnitude, and time to warrant the issuance of a Hazard Watch or a Hazard Warning.

(2) Similarly, the Director will also undertake to have reviewed and evaluated identifications or predictions of potentially hazardous events made by scientists outside the Geological Survey, as deemed appropriate or upon the request of the head of an appropriate State or Federal agency. The requestor will be notified promptly of the findings of the evaluation panel and, if appropriate, a Notice of Potential Hazard, a Hazard Watch, or a Hazard Warning will be issued.

c. *Notice of Potential Hazard.* (1) Where the Director has authenticated identification of an area as susceptible to a potentially hazardous condition, but available evidence is insufficient to suggest that a hazardous event is imminent or evidence has not been developed to determine the time of occurrence, the information will be prepared for normal publication.

(2) The Director or his designee will transmit such information, as soon as possible, as a Notice of Potential Hazard to appropriate Federal, State, and local officials responsible for the public safety and welfare and to the public by a press release. The reports and maps cited earlier that show the distribution of earthquake, volcanic, landslide, and subsidence hazards are examples of identifications of potentially hazardous conditions that will form the basis for notices of potential hazards.

(3) Notices of Potential Hazard will be accompanied by a description of the geologic and hydrologic conditions that exist, the factors that suggest that such conditions constitute a potential hazard, and the location or area they may affect. In most instances, it will not be possible to estimate the severity of the hazard or the time it might occur. Information such as possible earthquake recurrence intervals will be given, however, if justified by available information.

(4) Where available evidence suggests that a hazardous event could occur and that precursory phenomena exists that will better define the time, location, and magnitude of the event, the geologic conditions or processes likely to trigger a hazardous event will be monitored by the U.S. Geological Survey within the limits of available funds and manpower

d. *Hazard Watch.* (1) If existing or new information indicates that a region, area, locality, or geologic condition is undergoing change that may be interpreted as a precursor to a potentially hazardous event within an unspecified period of time (possibly months or years), such information will be evaluated and, if authenticated, the Director will assure that such information is transmitted promptly to civil authorities and the public as a Hazards Watch.

(2) Federal, State, and local officials responsible for public safety will be notified in advance of the intent to issue a Hazard Watch to enable them to invoke emergency preparedness plans for an orderly public response.

(3) Hazard Watches will be accompanied, to the extent possible, by a definition of the parameters of the expected event, including, in addition to the place, magnitude, and general time, the possible geologic or hydrologic effects and the uncertainties associated with each.

e. *Hazard Warning.* (1) When developing information from precursory phenomena, which have been monitored through an experimental or operational hazard assessment program, appears to signal a potentially hazardous event within a specific period of time(possibly days or hours), the information will be conveyed promptly to the Director for evaluation and consideration as a hazard prediction.

(2) The Director or his designee will determine whether or not the prediction has a sound scientic basis and is authenticated by a comprehensive evaluation. If a prediction is issued as a result of this review and authentication process, any uncertainties that may exist will be evaluated and stated.

(3) The Director, upon authentication of a prediction of an event of possible catastrophic proportions, will assure that such information is promptly transmitted as a Hazard Warning, first to Federal, State, and local officials responsible for public safety, to enable them to invoke emergency preparedness plans for an orderly public response, and then to the news media.

(4) Hazard Warnings will be accompanied, to the extent possible, by a definition of the parameters of the expected event including, in addition to the time, place, and magnitude, the possible geologic or hydrologic effects, and the uncertainties associated with each.

f. *Communication of Notices of Potential Hazard, Hazard Watches, and Hazard Warnings.* (1) Information leading to a Notice of Potential Hazard or a Hazard Watch will generally be obtained well in advance of an event and can be transmitted directly to concerned officials by letters and to the public by press releases to the news media.

(2) Where potentially hazardous conditions are monitored, local, State, and Federal authorities will be informed periodically of the results of such investigations and technical assistane, to the extent possible, will be extended as requested by these officials to assist in developing possible mitigation measures.

(3) At the present time, a capability to predict a geologic event of possible catastrophic proportions within days or hours does not exist except in rare cases. In such cases, where the information becomes available that suggests a potentially disastrous event may be imminent, public officials will be notified by telephone and such information will be transmitted directly to the public as a Hazard Warning. Public and existing Federal communication facilities, such as the Department of Commerce's Weather Radio System and the Department of Defense's National Warning System will be utilized whenever possible and appropriate.

(4) The Geological Survey will also communicate to responsible Federal Agencies and State and local governments, as soon as practicable, all available new knowledge as to geologic conditions or processes that may affect or alter public response to Notices of Potential Hazard, monitoring programs, Hazard Watches, or Hazard Warnings. This may result in the cancellation of the notice, watch, or warning, or a change in the hazard classification to better reflect an increased degree of uncertainty as to the time of occurrence of the event or a lessened sense of urgency.

(5) Notices of Potential Hazard, Hazard Watches, and Hazard Warnings to governmental agencies will also include:

(a) A statement of the authority of the U.S. Geological Survey for issuing the notice, watch, or warning:

(b) Copies of scientific papers or authentication reports that form the basis of the notice, watch, or warning;

(c) An offer to consult with any reviewers that the Governor or Governors of affected States may wish to appoint;

(d) An offer to provide appropriate technical assistance within areas of expertise in the Geological Survey in evaluating possible geologic hazards, as they may affect people and property;

(e) A statement of what additional steps, if any, the U.S. Geological Survey proposes to take to better define the degree or area of hazard; and

(f) A list of all parties to whom the notice, watch, or warning is being transmitted.

g. *Technical assistance.* (1) As used in this statement, technical assistance pertains to:

(a) advice of available Geological Survey personnel on subjects within their area of expertise—geology, hydrology, chemistry, and, to a limited extent, soil engineering, structural engineering, and land-use planning; and

(b) Deployment of available instruments to better define hazardous conditions, processes, or events.

(2) Technical assistance should not be interpreted to refer to:

(a) Funding for public works or hazard mitigation projects for which funds have not been allocated to the Geological Survey:

(b) Assignment of personnel or equipment to assess hazardous conditions outside geographical or topical areas of ongoing research or mapping programs except for unusual or compelling reasons.

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